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(Supplementary to Publication No. 217)

MAY 1932

# UNIVERSAL DUO-LUXE UNITS

## TYPE O

Always Delivering Outdoor Air to Occupied Rooms  
In Percentages Governed by Both Indoor and Outdoor Temperatures



JOHN J. NESBITT, INC.

*Executive Office and Factory,*

HOLMESBURG, PHILADELPHIA, PA.

NEW YORK OFFICE, 11 PARK PLACE



## **WHY** the Type O Duo-Luxe:

Type O Universal Duo-Luxe Heating and Ventilating Units have been specially designed for use where it is not required that a definite quantity of outdoor air be brought regularly into the classroom.

## **HOW** Type O Resembles Type D:

1. It is a double-duty unit, eliminating extra direct radiation in the ordinary classroom.
2. It is the unit de luxe, enclosing all pipes, valves and fittings in a handsome casing, which fits under most window sills and extends only eight inches into the aisle.
3. It syncretizes air-stream and room temperatures to a perfect harmony, thus removing the cause of cold drafts and overheating.

## **HOW** It Differs From Type D:

1. Type O units contain one copper radiator instead of two. This radiator heats the air-stream from an established minimum temperature to the degree necessary to maintain the desired room temperature.
2. The maintenance of the minimum air-stream temperature (usually 60 degrees) is accomplished by mixing just enough outside air with air drawn from the room.
3. Thus, the amount of air brought from out of doors varies according to the outside temperature, the solar heat in the room, and the number of occupants.

However, outside air is always being brought into the room during occupancy. (For percentages, see page 12.)

## **ADVANTAGES** of Using Type O:

Since the heat required for ventilation is only that necessary to raise the air-stream temperature from 60 to 70 degrees, the operation of the Type O Unit is exceptionally economical. Less steam is needed; therefore smaller boilers and pipes may be installed and less fuel is required.



# How the Type O Universal Duo-Luxe Unit Produces

## *Syncretized Air*

Syncretize—to blend, combine or  
reconcile inharmonious elements

*C*he Type O Universal Duo-Luxe employs a principle totally different from all others previously used in heating and ventilating units.

In the morning, before occupancy, the classroom is heated to within three degrees of the desired temperature by the recirculation of room air alone. Then, by an almost-human control of the mixing damper, the unit combines two streams of air, one from the room and one from outdoors, in the exact proportions necessary to maintain a constant discharge of air just above the fans (before the air passes through the single radiator) of 60 degrees. The radiator, therefore, has only to heat this air to the degree necessary to maintain the desired room temperature.

All day long the cycle continues: Room air of 70 degrees, let us say, is drawn into the unit, mixed with just enough outdoor air to cool it to 60 degrees, and the combined air-stream is passed through the radiator and heated sufficiently to maintain the desired 70 degrees throughout the entire occupied area of the room.

This process scientifically takes into account the heat given off by the occupants of the room, the effect of solar heat in the room, and the tempera-

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ture of the outside air, so that the percentage of outdoor air supplied to the room varies. *However, outdoor air is always being brought into the room during occupancy. In most cases one-third or more of outdoor air is delivered.* (For percentages at various outside temperatures see the table on page 13.)

Thus, the Type O unit syncretizes, reconciles, air-stream and room temperatures, as does the Type D double-radiator unit, described in

*True Harmony  
of Air-Stream  
and Room  
Temperatures*

Publication 217. No air is admitted to the room below 60 degrees, or 10 degrees less than the desired room temperature. This has been established by exhaustive tests as the limit of variation from room temperature at which air can be circulated without causing drafts.

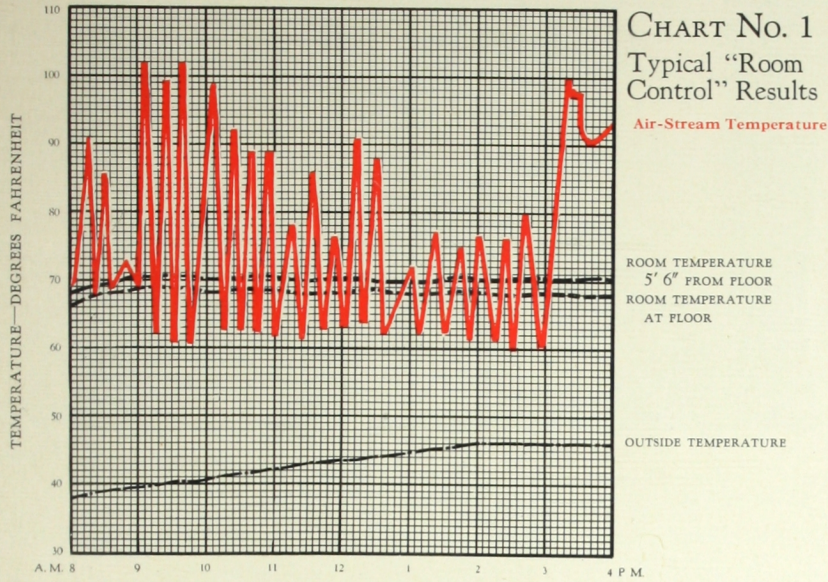
On the other hand, air can never be heated higher than is necessary to maintain the desired room temperature; this factor is governed by constant sampling of the room air and the automatic radiator control contained right within the unit. Cold drafts and overheating are made impossible. The resulting condition in the classroom is a comfortable, healthful uniformity of temperature at all points and levels of the occupied area—we call it Syncretized Air. (See charts on page 5.)

While Type O units cannot be used where it is required that the quantity of outdoor air delivered be invariable, they offer exceptional savings in installation and operation wherever it is desirable to use them.

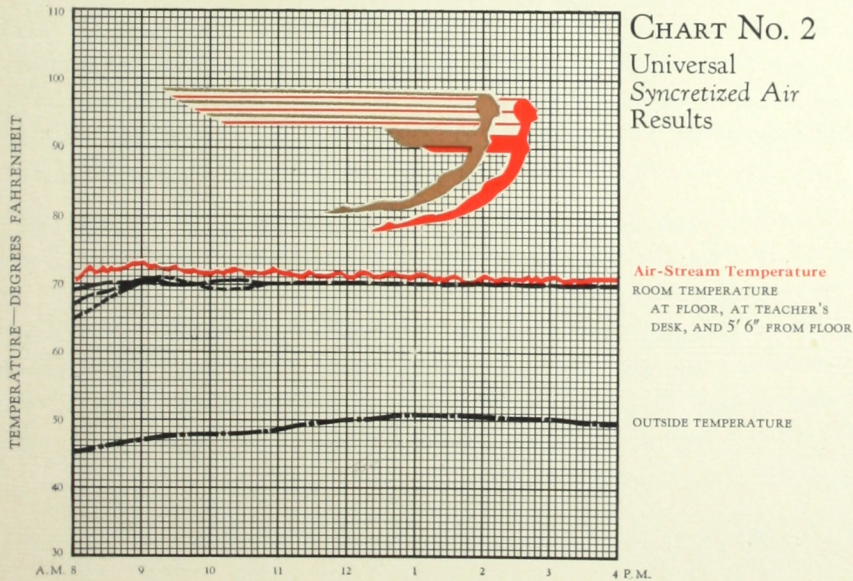
Like the Type D, the Type O unit completely encloses all pipes, valves, controls, etc., in a handsome baked-enamel casing, which fits under the window sill and extends only 8 inches into the aisle. It is a thing of beauty as well as a marvel of performance.



# "Room Control" Results compared to "Syncretized" Results

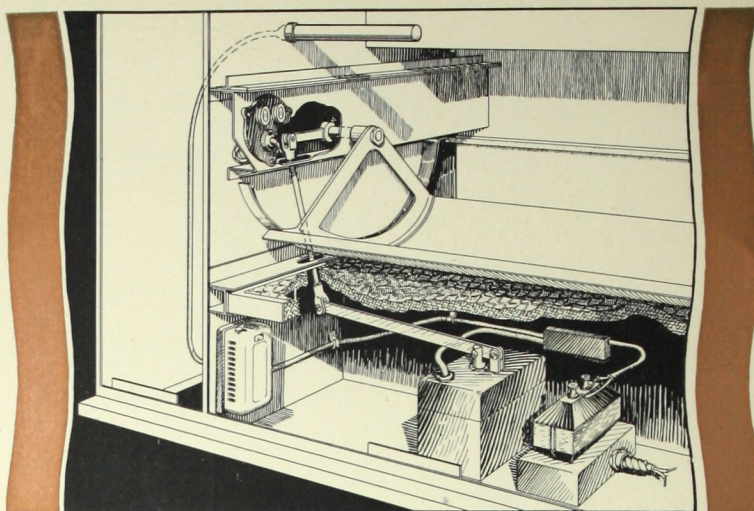


Typical results by former methods, with control of room temperature alone, as recorded by an actual test.  
Note the unruly air-stream temperature and the varying room temperatures at different levels.



Typical results with air-stream and room temperatures syncretized by the Duo-Luxe; from an actual recording in the same room. Room temperatures at various levels are uniform; cold drafts and overheating cannot exist.





*Electric Control of Mixing Damper on Self-contained Type O*

## *Details of Performance*

The operation of the inlet and recirculating damper, which regulates the mixture of room air and outdoor air brought into the unit, may be by a pneumatic or electric type motor. The thermostat controlling this operation is located just above the outlet of one of the Universal Unit fans. It is at this point that room air and outdoor air are most thoroughly mixed.

*How  
Cold Drafts  
Are Made  
Impossible*

This air-stream control is inoperative until the room temperature rises above 60 degrees (assuming that the room temperature desired is 70 degrees). Then, all day long, the stat controls the adjustment of the mixing damper so that the required proportions of outdoor air and 70-degree room air are drawn into the unit to maintain a discharge of 60-degree air at the fan outlet. Thus a minimum is established for all air discharged into the room during occupancy—a minimum of 10 degrees below the desired room temperature.

Our Research Department has definitely proved that air cannot be circulated in a room at less than 10 degrees below the desired room temperature without causing drafts. That is why both Type D and Type O Universal Duo-Luxe Units incorporate the principle of air-stream control.

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## How Overheating is Checked

Having established the minimum temperature at which air can be circulated without producing drafty conditions, the next step is to determine the number of cubic feet of air that it is necessary to circulate at this temperature in order to prevent overheating. The most logical basis on which we can determine this air quantity is that of temperature differences in the removal of body heat.

By a long series of practical tests conducted in occupied classrooms, our Research Engineers conclusively proved that 30 cubic feet of air per minute per occupant, circulated at a temperature of 60 degrees, would prevent overheating in classrooms exposed to the intense heat of the sun.

## Syncretized Air

Upon these scientific bases, then, we have established an air-stream minimum temperature of 60 degrees, and an air volume of approximately 30 cubic feet of air per minute per pupil, as read by an anemometer. The result, in the classroom, is a true harmony of air-stream and room temperatures—uniform room temperature throughout the entire occupied area—cold drafts and overheating entirely overcome—Syncretized Air.

## Percentage of Outdoor Air

The quantity of outdoor air supplied to the classroom by Type O units varies. (With Type D units, the quantity supplied remains definitely fixed; see Publication 217.) For example: in the Philadelphia area, the average outside temperature during the heating season, between 8:00 A. M. and 4:00 P. M., is 42.5 degrees. Therefore, a schoolroom in that area, equipped with a Type O Universal Duo-Luxe Unit, would receive an average of 35% of its total volume of air from out-of-doors. On the recommended basis of 30 cubic feet per minute per occupant, it would thus require 10.5 cubic feet of outdoor air of 42.5 degrees mixed with 19.5 cubic feet of 70-degree room air to maintain an air-stream of 60 degrees at the control stat. If the outside temperature should rise above 42.5 degrees, a larger volume of outdoor air would be drawn in; and, of course, if the outside temperature should lower, a smaller volume would be taken from out of doors.

## Economies Effected

The economy of this method of control is quite obvious. The total ventilation load is only that required to heat the air-stream from the established minimum temperature of 60 degrees to the desired room temperature of 70. The table of capacities on page 12 shows that when 800 cubic feet of air are being circulated, only 35 square feet of equivalent direct radiation are required for heating the air for ventilation. Whenever a 60-degree mixture of room air and outdoor air is sufficient to maintain a 70-degree room temperature, *no steam is required on the radiator.*

By reason of their light load, Type O units permit the installation of smaller boilers, pipes, valves, etc., effecting important savings in fuel. Also, direct radiation is eliminated in the ordinary classroom. All in all, they are the most economical units for the automatic heating and ventilating of classrooms, offices and similar places of assembly.



# A Dozen Duo-Luxe Distinctions

1. High velocity, streamline outlet grille; vertical discharge of air with uniform movement over entire grille.

2. Copper radiator, heats air to temperature required to automatically maintain desired room temperature. Internal steam-distributing tubes cause smallest quantity of steam to be evenly distributed over entire radiator.

3. Thermostat syncretizes air-stream and room temperatures by controlling position of inlet and recirculating mixing damper, so as to maintain a 60° mixture of outdoor and room air at the fan outlet, after room temperature reaches 67°.

4. Duct through which room air is constantly drawn over the stat controlling the radiator steam supply, and thus maintaining desired room temperature.

5. Quiet-operating, low-speed motor and fan assembly.

6. Aluminum inlet and recirculating mixing damper; closed to outdoor air until room temperature reaches 67°; opens to admit just the right amount of outdoor air thereafter, as regulated by thermostat (3).

7. Air filter cleans outdoor and room air before air reaches motor and fan assembly.

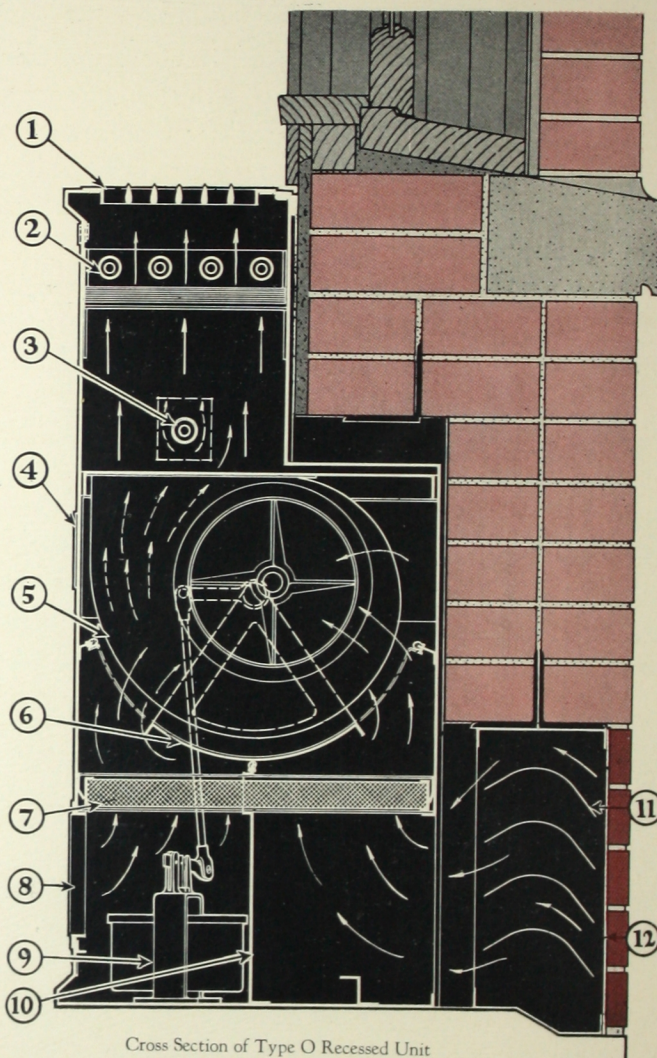
8. Recirculating grille through which room air enters unit.

9. Pneumatic motor for operation of inlet and recirculating mixing damper.

10. Solid steel wall prevents outdoor air from entering the room before passing through the radiator.

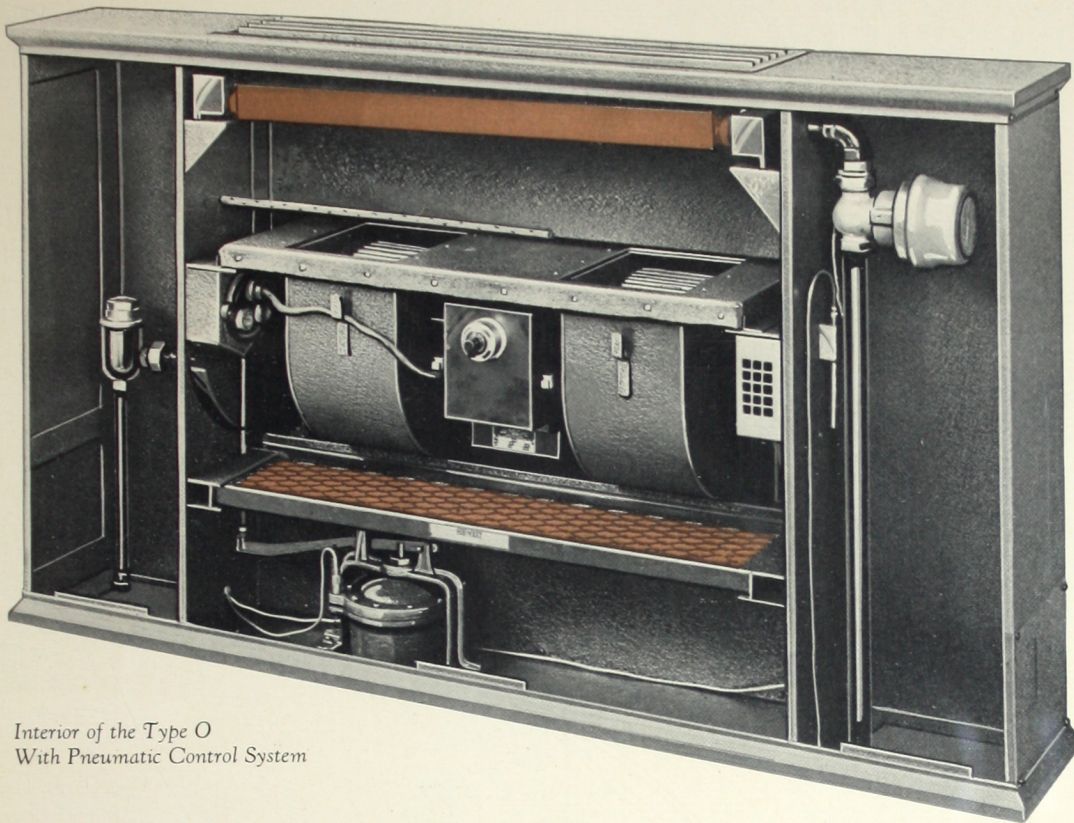
11. Stationary storm-proof louvres in a deep galvanized iron wall box.

12. Heavy bronze or aluminum inlet grille in a choice of modern designs.



Cross Section of Type O Recessed Unit  
(Recesses 6 inches into the wall)





Interior of the Type O  
With Pneumatic Control System

## *Fully-automatic Operation* by Self-contained or Pneumatic Control Systems

SINCE overheating and cold drafts can only be conquered by syncretized control of air-stream and room temperatures, we recommend that Universal Type O Duo-Luxe Units be specified only when automatic control equipment is contemplated. The Type O unit may be controlled by a self-contained system (steam control of radiator; electric control of mixing damper) or by a pneumatic system. The photograph above shows pneumatic control. The following two pages explain, in simple terms, the operation of both systems.

It is entirely practicable to heat and ventilate the ordinary classroom with the Type O unit, without the aid of extra radiation. (It is considered good practice to provide direct radiation in corner rooms having two exposures.) The savings effected through the elimination of the direct radiator, piping, valves, traps and control are more than sufficient to pay for the complete automatic control system of the Duo-Luxe. The results obtained from the Universal Type O Duo-Luxe Unit without direct radiation in the classroom, but with automatic control, far exceed, in both performance and economy, those that can be obtained from a unit system combining direct radiation without control.

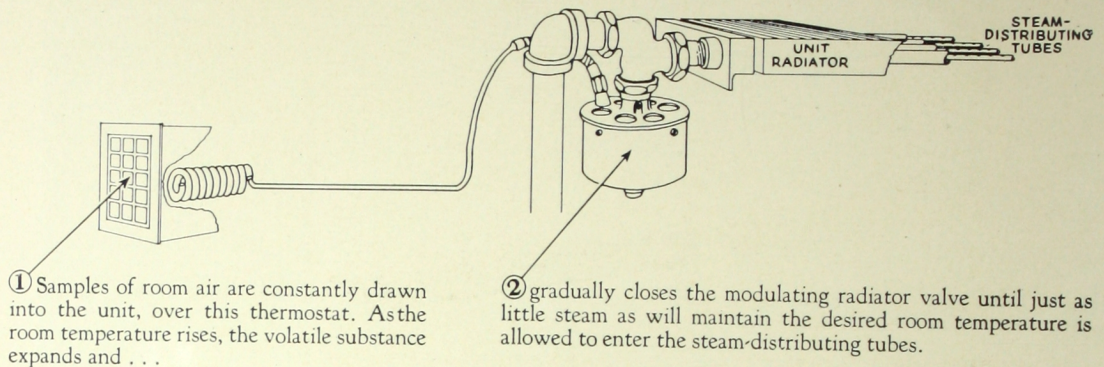


# How the Type O Universal

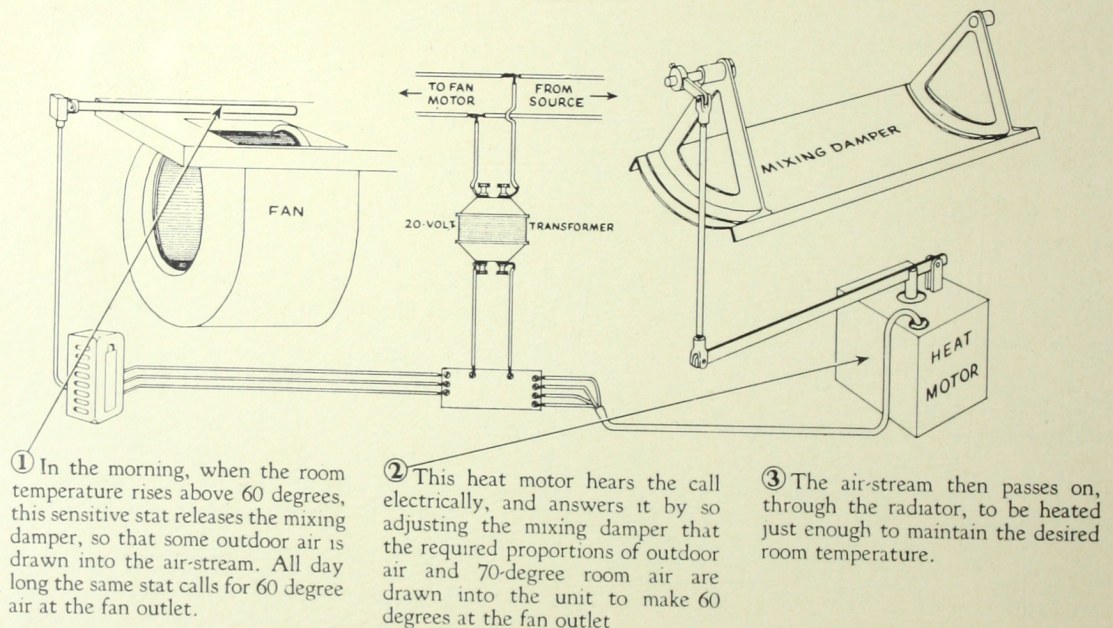
## SELF-CONTAINED TYPE:

(Steam Control of Radiator; Electric Control of Mixing Damper)

### *Control of Room Temperature*



### *Control of Air-stream Minimum Temperature*



## *Universal Control of Air-stream and Room*

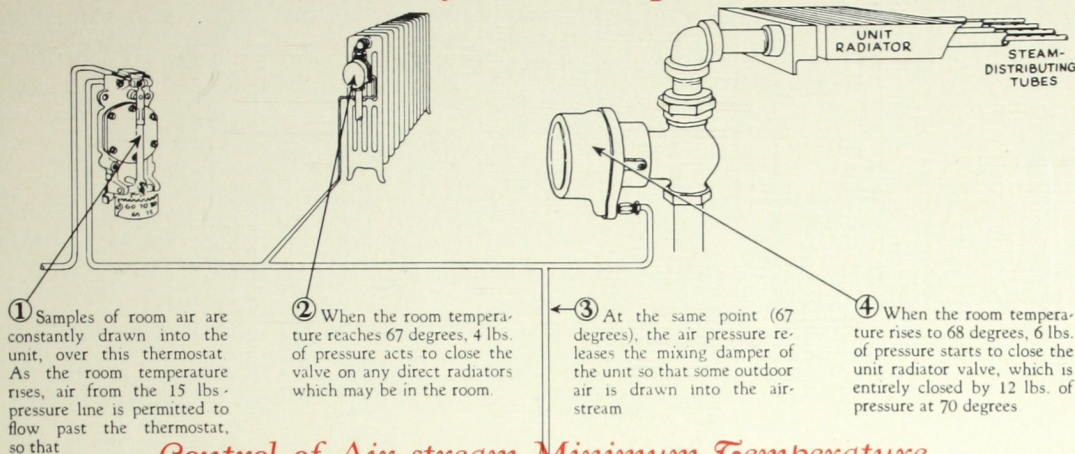
PAGE 10



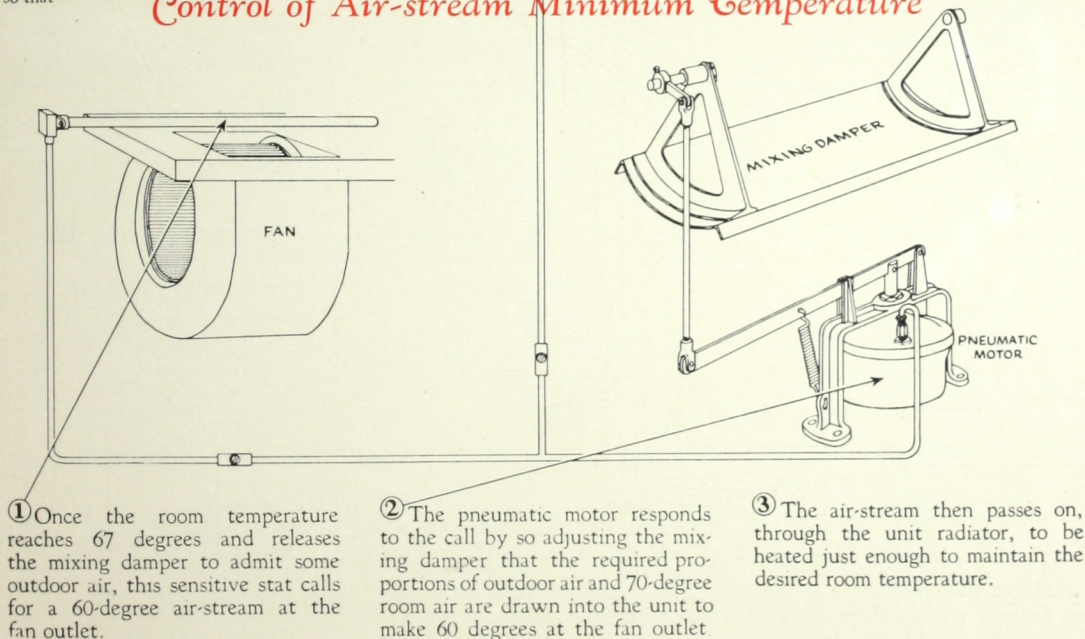
# Duo-Luxe Units Function—

## PNEUMATIC TYPE:

### *Control of Room Temperature*



### *Control of Air-stream Minimum Temperature*



*Temperatures Produces Syncretized Air*



## Table of Capacities

Series Number	C. F. M.	Heat for Air E. D. R.	Surplus Heat E. D. R.	Total Heat E. D. R.
O-3254	600	22 21	43 84	65 105
O-3254	800	35 34	70 134	105 168
O-3263	1000	43 42	87 167	130 209
O-3263	1260	54 52	110 210	164 262
O-3272	1560	68 65	135 262	203 327

For method of rating please refer to page 18, Publication No. 217.

The term "surplus heat" expressed in E. D. R. represents the difference between the total heating capacity of the unit and the E. D. R. required to raise the temperature of the air to 70°.

In determining the heating capacity required for a given room the surplus heat can be deducted from the total requirements. Thus, in the case of high temperature, Type O Unit, 1260 C. F. M., 210 square feet of direct radiation could be omitted by the installation of this Unit.

E. D. R. required for heating air to 70° is figured on the basis of rated C. F. M. at final temperature; therefore, the C. F. M. at 70° will vary as the absolute final temperatures vary.

Red figures indicate "high temperature" radiator; black, "low temperature" radiator.

All component parts of the unit are like those described in Publication 217, and Type O units are available in the same types as shown on pages 14 and 15 of the same publication. Dimensions of Type D, as given on pages 22 to 27, apply to Type O for a given air capacity.

## Proportions of Outdoor and Room Air Supplied

BY THE UNIVERSAL TYPE "O" DUO-LUXE UNIT, FOR VARIOUS OUTDOOR TEMPERATURES,  
BASED UPON CIRCULATING 30 C.F.M. PER PERSON

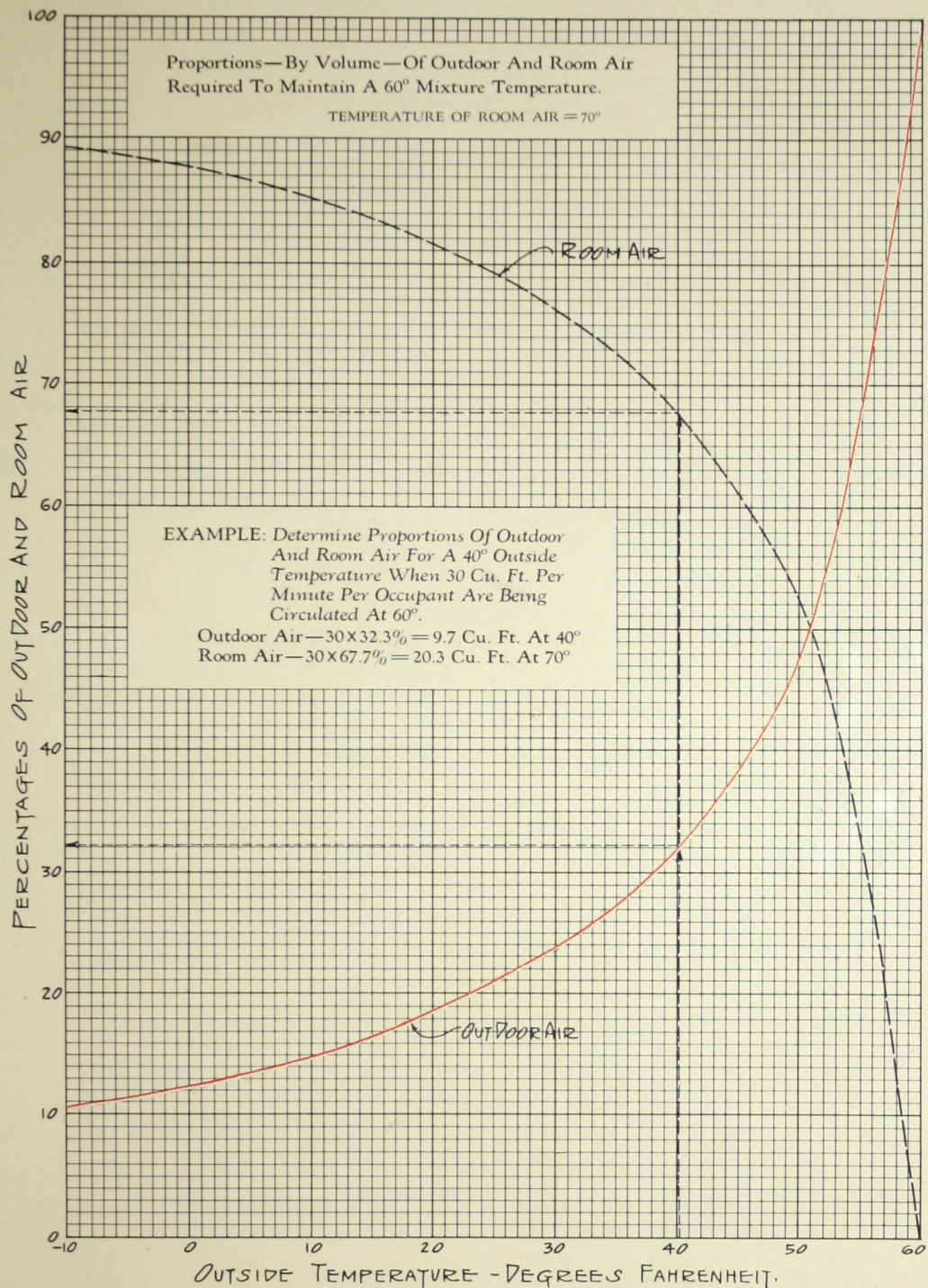
Outside Temperature	-30°	-20°	-10°	0°	10°	20°	30°	40°	50°	55°	60°
Room Temperature	70°	70°	70°	70°	70°	70°	70°	70°	70°	70°	70°
Outside Air C. F. M.	2½	3	3¼	3¾	4½	5½	7	9¾	14¾	19¾	30
Room Air C. F. M.	27½	27	26¾	26¼	25½	24½	23	20¼	15¼	10¼	0

Outside volume as shown measured at outside temperature.

Room volume as shown measured at room temperature.

*Chart on opposite page gives proportions by volume of outdoor and room air for all outside temperatures down to -10 degrees.*







# Typical Specifications

## Universal Type O Duo-Luxe Units

1. Heating and ventilating contractor shall furnish and install complete and ready for use, Universal Type O Duo-Luxe Heating and Ventilating Units, as manufactured by John J. Nesbitt, Inc., Holmesburg, Philadelphia, Pa., and sold by the American Blower Corporation, Detroit, Mich., of number, size and type shown on plans and specified herein.
2. Duo-Luxe Units shall be guaranteed to deliver the full volume of air shown on plans from the room or outdoors, or part from the room and part from outdoors. The radiator must have sufficient capacity so that, with steam at two-pounds pressure, the surplus heat produced shall be as shown on plans.
3. Duo-Luxe fans shall be of the slow-speed multi-blade type, operating at a tip speed not greater than 1500 feet per minute when delivering their full rating against the resistance of the Unit.
4. Motor shall be designed to operate on phase, cycle, volt alternating current, or direct current volts, and shall have ample power to drive fans continuously with a temperature rise not to exceed 40° C.
5. The motor shall be condenser-transformer, variable speed for single phase, alternating current; and transformer, variable speed for polyphase, alternating current; and series wound, variable speed for direct current. All alternating current motors shall be induction type, free of starting mechanism or other sliding electrical contact, and non-radio-interfering.
6. The motor must be suspended from specially designed springs that dissipate any magnetic hum or vibration.
7. Bearings shall be phosphorous bronze, of liberal size, with wool-packed oiling system, which will permit 3000 hours of operation with one oiling.
8. Each motor must be provided with a three-speed control switch set to give speed variations of approximately 100 R. P. M. per stage.
9. Each Duo-Luxe Unit shall have an individual fuse block with fuses, entirely wired within the unit, wiring terminating at a block with binding post to which electrical contractor will make all electrical connections to Unit.
10. Radiator shall be constructed entirely of copper with no soldered, brazed, or packed joints, and all prime surface shall be seamless drawn copper tubing provided with copper fins. Radiator shall be guaranteed to withstand freezing without bursting.
11. The tubes of the radiator shall be provided with internal steam-distributing tubes. The steam-distributing tubes shall be constructed of brass and shall be provided with a number of orifices located so as to cause uniform distribution of steam throughout the entire length of the radiator.

## Use Either 12 or 12-A

12. Regulation contractor shall furnish to heating contractor, at building, one thermostatic supply valve to be installed on the supply connection to unit radiator. The control contractor must supply and install in the unit ventilator immediately above the discharge of the fan a leak stat connected to the thermostatic damper motor operating the inlet and recirculating mixing damper. This stat shall be set to maintain a temperature of 60° at the fan discharge, but will not be operative until after room thermostat functions.
- 12-A. The steam supply to the radiator in each Duo-Luxe Unit must be provided with self-contained



automatic control valve. The thermostat of the valve shall be located in the air duct so that room air at high velocity is circulated over the thermostat.

13. Each Duo-Luxe Unit shall be provided with an aluminum inlet and recirculating mixing damper supported on brass bearings. The damper shall be provided with felt stops, and when in a closed position must prevent outdoor air from entering the unit.

The damper must be connected to electric or pneumatic attachment to regulate the proportions of outdoor and room air required to maintain a temperature of 60° at the fan discharge.

#### *Use Either 14 or 14-A*

14. The inlet and recirculating mixing damper shall be operated by pneumatic motor provided by control contractor. This damper motor will be supplied to the unit manufacturer by the control contractor, but must be installed and connected to the inlet and recirculating mixing damper by unit manufacturer.

- 14-A. The inlet and recirculating mixing damper of each Unit shall be provided with a self-contained electric heat motor and electric potentiometer-type thermostat having a capillary tube and extended bulb. The bulb shall be located at the fan discharge and shall be connected to the potentiometer by the capillary tube.

Current for the operation of the heat motor shall be taken from the electric lines to the fan motor connected to a 20 volt transformer, all within the unit casing.

Electric thermostat shall be set to maintain a temperature of 60° at the discharge of the fan by operating the heat motor to open the inlet and recirculating mixing damper to admit just the right quantity of air necessary to maintain an air mixture of 60°.

15. A steel wall shall be provided between the outdoor air inlet chamber and the recirculating

room air inlet chamber so that the air cannot enter the room without passing through the radiator.

16. Duo-Luxe cabinets shall be constructed of full finished furniture steel of not less than No. 14 gauge with olive green enamel baked on. Unit shall be provided with suitable locks on removable front, and extra keys shall be provided. All parts of cabinet shall be easily accessible for cleaning.
17. The casing shall be constructed to enclose all steam, electric and control equipment and connections thereto.

#### *Use Either 18 or 18-A*

18. The outdoor air intake to each Duo-Luxe Unit shall be made through wall as shown on plans. Each Unit shall be provided with a No. 14 gauge galvanized iron storm louvre. The blades forming the louvre shall be of special shape, designed to offer a minimum resistance to the flow of air, and to keep water from entering the building. On face of each wall box provide a one-eighth inch thick bronze inlet grille, design number (select design from page 31, Publication No. 217, and insert number.)

- 18-A. The outdoor air intake to each Duo-Luxe Unit shall be made through window inlet connection as shown on plans. Each Unit shall be provided with a No. 16 gauge steel intake connection to fit window construction. Each window intake shall be provided with No. 16 gauge lattice design steel inlet grille. The inlet grille and connection thereto shall be finished to match the finish of Unit casing.

19. All Duo-Luxe Units shall be provided with air filters of the adhesive, impingement type so located as to clean all air whether from room or outdoors before air comes in contact with motor and fan assembly. Installation shall be complete with necessary cleaning and oiling vats for filters. Filters must be easily removable for cleaning.

*The Universal Duo-Luxe Type O Unit is designed to operate on a two-pipe vacuum or vapor return line system with thermostatic return trap on each unit.*

*All heat sources should be controlled, and exposed piping insulated to prevent overheating in mild weather.*





THE STANDARD BY WHICH  
ALL OTHER MAKES ARE MEASURED

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